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Request for grant of a patent

The Patent Office
Cardiff Road
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30 MAR 2004

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3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

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Patents ADP number *(if known)* 06138044009

If the applicant is a corporate body, give the country/state of its incorporation
Country: GB
State:

4. Title of the invention
IMAGE PROCESSING SYSTEM

5. Name of agent
"Address for Service" in the United Kingdom to which all correspondence should be sent

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6. Priority: Complete this section if you are declaring priority from one or more earlier patent applications filed in the last 12 months.

Country	Priority application number	Date of filing

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7. Divisionals, etc: Complete this section only if this application is a divisional application or resulted from an entitlement dispute.

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8. Is a Patents Form 7/77 (Statement of inventorship and of right to grant of a patent) required in support of this request?

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Priority documents	
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Signature Beresford & Co
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Date 30 March 2004

12. Name and daytime telephone number of person to contact in the United Kingdom

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IMAGE PROCESSING SYSTEM

The present application concerns image processing systems. Embodiments of the present application concern image processing systems for generating display data.

Many circumstance require portions of an image display to be highlighted or emphasised. Thus for example in an aeroplane cockpit, it may be necessary to draw a pilot's attention to a reading on a particular gauge. Conventionally highlighting a portion of an image display has been achieved in a number of different ways including changing the colour of a portion of a display or alternatively highlighting an aspect of a display by using flashing lights or flashing display items etc.

A problem with existing methods for highlighting information is that the use of additional colour or a blinking light increases the overall information content and thereby the cognitive load on a user. As a result, in a complex visual environment such as within a cockpit, although flashing lights and different colours may help direct a pilot's attention, the

increased amount of information can prevent or slow down a pilot from filtering the information appropriately and therefore may lead a pilot to miss other information that is necessary for safe flight.

A similar problem of information overload can arise with in-car navigation systems. When driving, a driver's attention should mainly be directed towards the driving conditions on the road. Highlighting information on an in-car navigation screen by way of blinking lights or garish colours can distract a driver's attention and is therefore potentially dangerous.

An alternative system for generating image displays in which portions of a display are brought to a user's attention but which do not increase the cognitive load on a viewer is therefore desirable.

In accordance with one aspect of the present invention there is provided a method of generating image data comprising the steps of: receiving an original image; receiving data identifying portions of an original image to be highlighted; and generating image data representative of a composite image wherein portions

of said composite image corresponding to portions of image to be highlighted correspond to said portions of said original image and the remaining portions of said composite image correspond to corresponding portions of said original image to which a blurring function has been applied.

Further objects and aspects of the present invention will become apparent with reference to the following description and accompanying drawings, in which:

Figure 1 is a schematic block diagram of a display system including an image generation module in accordance with a first embodiment of the present invention;

Figure 2A is an exemplary illustration of an original image showing a bank of 16 dials;

Figure 2B is an exemplary illustration of the image of Figure 2A to which a blurring function has been applied;

Figure 2C is an exemplary illustration of a composite image of the bank of 16 dials of Figures 2A and 2B in

which some of the dials of the composite image have been highlighted by selectively combining portions of the images of Figures 2A and 2B;

Figure 3 is a flow diagram of the processing of the image generation module of Figure 1;

Figure 4 is a schematic block diagram of a display system including an image generation module in accordance with a second embodiment of the present invention;

Figure 5 is a schematic block diagram of an in-car navigation system in accordance with a third embodiment of the present invention; and

Figure 6 is a schematic block diagram of a fourth embodiment of the present invention.

FIRST EMBODIMENT

A first embodiment of the present invention will now be described with reference to Figures 1, 2A-C and Figure 3.

Referring to Figure 1, which is a schematic block

diagram of a display system for an aeroplane cockpit, a display system is provided comprising a display generation module 1 arranged to generate display data, which is displayed on a display screen 2. In addition to being connected to the display screen 2, the display generation module 1 is also connected to a number of detectors 3-1 - 3-N. These detectors 3-1 - 3-N comprise conventional aeroplane detectors for detecting wind speed, altitude etc. As in a conventional display system, the display generation module 1 is arranged to receive signals from the detectors 3-1 - 3-N and generate screen display data representing the readings from the detectors 3-1 - 3-N, which are then shown on the display screen 2.

In addition to generating conventional screen displays, in accordance with the present invention, the display generation module 1 is also arranged to generate display data for screen displays in which portions of the display are highlighted in a manner, which does not increase the cognitive load on a pilot.

More specifically, in this embodiment, the display generation module 1 is arranged to determine whether the inputs received from the detectors 3-1 - 3-N are

such that a pilot's attention should be drawn to a particular portions of a generated display. If this is the case, instead of displaying a normal image, the display generation module 1 generates a composite image in which less important areas on a display appear slightly blurred whilst important areas, which are to be emphasised, remain sharp.

The applicants have established that when confronted with images comprising areas, which are in focus, and areas, which are out of focus, a viewer's attention is preferentially drawn towards those areas of an image, which appear sharp. It has therefore been appreciated that by generating combined images in which certain portions of an image remain sharp and other areas appear more blurred, a means is provided to direct a viewer's attention toward considering the sharp areas of an image first.

It is believed that this effect arises for the following reasons. During natural vision in a 3D environment, whenever a viewer chooses to attend to an object or to a particular region in space, the viewer will point his eyes to the particular location of interest. The rest of the surrounding scene is then

blurred (by the eyes optics and/or by neural mechanisms). Ordinarily, a viewer will be unaware of this blurring effect due to the processing of an image by the viewer's brain.

As the neural mechanisms that control spatial attention and eye movements can be controlled independently from each other; the location to which a viewer chooses to attend need not coincide with the location to which the viewer points his eyes. The applicants believe that by selectively blurring the background (or any undesired regions in an image) it is possible to guide a viewer's eyes and their spatial attention to point to the same spatial location(s) in an image at the same time.

Selectively blurring areas of an image display therefore provides means for guiding a viewer's attention towards the sharper areas of an image and hence a means for directing a viewer's attention towards information that is currently identified as important.

Further, in contrast to conventional methods for highlighting information, the selective blurring of

portions of an image reduces rather than increases the amount of information presented to a viewer. The present invention therefore enables information to be highlighted in a manner, which reduces the likelihood that a viewer will become overloaded with information. The present invention is therefore particularly applicable to displays within aircraft or motor vehicles or the like where it is desirable to highlight information whilst not overly diverting the attention of a pilot or driver.

In this embodiment, the display generation module 1 comprises an image generation module 10, which is arranged to receive signals from the detectors 3-1 - 3-N and generate original images comprising a bank of dials representing readings from the detectors 3-1 - 3-N.

An exemplary illustration of a bank of 16 dials representing readings from 16 detectors is illustrated as Figure 2A.

The generated images are then passed by the image generation module 10 both to an image combination module 11 and to a blur engine 12. The blur engine 12

processes the received original images from the image generation module 10 to generate blurred images from the original images. These blurred images are also passed to the image combination module 11.

Figure 2B is an exemplary illustration of a blurred image generated by processing the original image of Figure 2A.

Ordinarily when the image combination module 11 receives original image data from the image generation module 10, the image combination module 11 passes display data corresponding to the received original image to the display screen 2. This causes a sharp display to be shown to a user.

However, in certain circumstance when the display generation module 1 determines that a pilot's attention should be directed to a limited subset of the dials, the image combination module 11 instead generates a hybrid image, which is passed to the display screen 2. These hybrid images comprise images in which portions of the image correspond to portions of a blurred image generated by the blur engine 12 and other portions of the image correspond to the original

image generated by the image generation module 10.

Figure 2C is a schematic illustration in which some of the dials correspond to dials in the original image Figure 2A whereas others correspond to dials appearing in Figure 2B.

As will become apparent looking at Figure 2C, a viewer's attention is drawn to the sharper portions of the image and hence generating a combined image in this way enables the display generation module 1 to direct the viewer's attention to specific readings of the dials.

Further, it will be appreciated that as the generation of this image does not increase the amount of information presented to a user, the highlighting of areas of a generated display in this manner does not increase cognitive load and is therefore a relatively unobtrusive way in which to highlight information within a cockpit.

In order to determine when it is appropriate to highlight certain information on the display screen, the display generation module 1 in this embodiment

also comprises a status determination module 15 which is arranged to receive signals from the detectors 3-1 - 3-N and identify when the readings from the detectors 3-1 - 3-N indicate that certain dials on the display should be highlighted.

The status determination module 15 then outputs status data to a selection module 16 which is connected to a selection database 18 storing a series of records 19-1 - 19-M each comprising status data and selection data where the status data identifies a status which can be output by the status determination module 15 and the selection data comprises data identifying areas of a display to be highlighted.

When the selection module 16 receives status data from the status determination module 15, the selection module 16 accesses the selection database 18 and retrieves the record 19-1; 19-M having status data corresponding to the status data received from the status determination module 15 and passes this selection data to the image combination module 11 to identify areas of the screen display which are to be highlighted.

The processing undertaken by the display generation module 1 will now be described in greater detail with reference to Figure 3, which is a flow diagram of the processing performed by the display generation module 1.

When an image is to be displayed on the display screen 2, initially (s1) the display generation module 1 receives data from the detectors 3-1 - 3-N. These readings are passed to both the image generation module 10 and the status determination module 15.

When readings from the detectors 3-1 - 3-N are received by the image generation module 10, the image generation module 10 proceeds to generate (s2) image data for an original screen display in which the readings are illustrated. In this embodiment, this image comprises an image by a series of dials indicating the detected readings. This image of dials indicating the detected readings is then passed by the image generation module 10 to both the image combination module 11 and the blur engine 12.

When image data is received by the blur engine, the blur engine 12 processes the image to generate (s3) a

blurred image corresponding to the received original image. In this embodiment this blurred image is obtained in a conventional manner by processing an original image pixel by pixel and calculating corresponding pixel values in a blurred image by determining the weighted average of pixel values in the same vicinity as an original pixel in an original image where the weighting of pixel values is based on a Gaussian function which declines with the distance between a pixel for which image data is being generated and the pixel for which a contribution is being calculated.

At the same time as when the image generation module 10 receives readings from the detectors 3-1 - 3-N, the same readings are also passed to the status determination module 15. When readings are received by the status determination module 15, the status determination module 15 processes the received readings to determine (s4) whether the readings from the detectors 3-1 - 3-N are such to indicate that a pilot's attention should be focussed on a limited number of the dials in the generated image for the display screen 2. The status determination module 15 then outputs status data. The status data will either

identify a default status indicating that there is no particular need for a pilot to focus on specific readings within the screen display or a specific status determined from the received readings. The generated status data is then passed to the selection module 16.

When the selection module 16 receives status data, initially the selection module 16 checks whether the received status data indicates a default status. If this is the case the selection module 16 passes selection data to the image combination module 11 to cause the image combination module 11 to pass original image data received from the image generation module 10 the display screen 2.

If the status data received by the selection module does not indicate a default status, the selection module 16 then (s5) accesses the selection database 18 and retrieves from the selection database 18 a record 19-1; ...; 19-M having status data corresponding to the status data received from the status determination module 15. The selection module 16 then passes selection data corresponding to the selection data included in the retrieved record 19-1; ...; 19-m to

the image combination module. This selection data will identify certain areas of an image that are to be highlighted within the image on the display screen 2.

When the image combination module 11 receives selection data from the selection module 16, if the selection data indicates a default selection, the image combination module 11 passes as display data a copy of the original image data received from the image generation module 10. This original image is then displayed (s7) on the display screen 2.

If instead the selection data identifies a series of areas in a display which are to be highlighted, the image combination module 11 generates display data by copying the original image data received from the image generation module 10 to generate (s6) image data for the areas of an image which are identified as to be highlighted and copying image data for the remaining areas from the blurred image received from the blur engine 12. The resultant combined image is then output and displayed (s7) on the display screen 2.

Where the image displayed on the display screen 2 is a

combination of blurred and sharp areas, the viewer's eye will be drawn toward the sharper areas of the display and hence by presenting a viewer with a combined image, a means is provided to draw the viewer's attention to certain aspects of the display.

Should a viewer wish to review the entirety of the display, where the blur engine 12 generates a blurred image, which does not significantly degrade the visual information, contained in blurred areas of the display, this will remain possible.

Alternatively, a viewer could be provided with an override button monitored by one of the detectors 3-1 - 3-N. When such an override button was depressed, the status determination module 15 could then be caused to generate the status data indicating a default status so that the display screen 2 displays an original image in which the entirety of the image appears sharp.

SECOND EMBODIMENT

A second embodiment of the present invention will now be described with reference to Figure 4, which is a schematic block diagram of a display system embodying

the present invention.

In this embodiment the display generation module 1 of the first embodiment is replaced by a modified display generation module 20 in which the image combination module 11, blur engine 12, selection module 16 and selection database 18 are replaced by a selective blur module 22 and a blur function database 24. The remaining aspects of this embodiment are exactly the same as has been described in the first embodiment and are indicated by the same reference numerals as those appearing in Figure 1.

In this embodiment, the selective blur module 22 is arranged to receive original image data from the image generation module 10 and status data from the status determination module 15. When status data received by the selective blur module 22 indicates a default status, the selective blur module 22 passes original image data received from the image generation module 10 to the display screen 2 in an unmodified form.

In contrast, when received status data does not indicate a default status, the selective blur module 22 accesses the blur function database 24 to retrieve

a record 26-1; ... 26-M stored within the blur function database 24. In this embodiment, each of these records 26-1; ... 26-M comprises status data and a blur function. When the blur function database 24 is accessed by the selective blur module 22 the selective blur module 22 retrieves the record 26-1; ... 26-M from the blur function database 24 having status data corresponding to the status data received by the selective blur module 22 from the status determination module 15. The selective blur module 22 then utilises the blur function of the record 26-1; ... 26-M retrieved from the blur function database 24 to process the original image data received from the image generation module 10.

More specifically, in this embodiment each of the records 26-1; ...; 26-M stored within the blur function database 24 contains blur function data identifying how a selectively blurred image is to be generated from an original image received by the selected blur module 22.

Thus for example for areas of an image which are to be represented as sharp portions of an image, the blur function of the record will comprise a function

identifying that pixels in a selectively burred image corresponding to pixels in these areas should be copies of the image data for corresponding pixels in an original image received from the image generation module 10.

Conversely, for pixels in an image, which are to be represented as blurred portions in a selectively blurred image, the blur function data will identify how pixel data in the blurred areas of the selectively blurred image are to be derived from groups of pixels in an original image received from the image generation module 10.

When the selective blur module 22 has processed an entire image using retrieved blur function data a selectively blurred image is then passed to the display screen 2 where it is displayed.

By having the selective blur module 22 process different areas of an original image in different ways, in contrast to the first embodiment where an entire blurred image is generated by a blur engine 12, the processing performed by the display generation module 20 is reduced as blurred image data is only

generated for selected areas of an original image.

THIRD EMBODIMENT

A third embodiment of the present invention will now be described with reference to Figure 5 which is a schematic block diagram of a in-car navigation system embodying the present invention.

As is shown in Figure 5, an in-car navigation system 30 is provided that is connected to a display 31 which is arranged to display maps 32 to a driver to enable the driver to identify a route to a desired destination.

As in a conventional in-car navigation system, the in-car navigation system comprises an input module 33 for enabling a user to identify their desired destination; a route calculation module 34 for determining a route from a car's current location to the desired final destination; a GPS detector 35 to enable the in-car navigation system to identify a car's present location; a map database 36 for storing map images for display and a map selector 37 arranged to utilise the current position signals received from the GPS detector 35 and route calculated by the route

calculation module 34 to select an appropriate map image from the map database 36 which is then passed by the map selector 37 to an output module 38 which generates display data causing a map 32 to be displayed on the display screen 31.

In this embodiment, the output module 38 in addition to being arranged to receive map images selected from the map database 36 by the map selector 37 is also arranged to receive route data from the route calculation module 34. The output module 38 then processes the received map image so as to blur all the areas in a map image, which do not correspond to roads on the identified route received from the route calculation module 34 and then outputs this modified map in use as display data. As these roads on the identified route appear sharp whereas the rest of the map appears blurred, the processing performed by the output module 38 provides a means for highlighting the driver's route.

Thus for example in the case of the map 32 shown in Figure 5 a route from the bottom left-hand corner of the display 31 is highlighted comprising a route via Fortune Street, Duffrin Street, Dunhill Row, Bath

Street, Nile Place and Provost Street up to the top of the map 32.

Additionally, however, as the method used to highlight route does not add additional information that needs to be processed by a driver, the highlighting is such to be less likely to be distracting to a driver in use when driving on the road.

Further, the selective use of blurring can also be used to provide a driver with an indication of when he was off route. Thus for example, in some embodiments, the current location of a vehicle could be indicated by a symbol appearing in the display 31. In such embodiments, when a vehicle departed from the planned route, the departure from the planned route would be indicated to the driver by the apparent change in appearance of the symbol when the symbol moved from a sharp region of an image into a blurred region.

FOURTH EMBODIMENT

A fourth embodiment of the present invention will now be described with reference to Figure 6.

Figure 6 is a schematic block diagram of a computer 40

connected to a display screen 41. In addition to being connected to the display screen 41 the computer 40 is also connected to a keyboard 42 and a mouse 43.

In this embodiment, the computer 40 is programmed so as to become configured as a system for helping children learn to read. To that end stored within the memory of the computer 40 are a number of functional modules shown as modules 44-47. Specifically in this embodiment, these modules comprise a normal font store 44, a blurred font store 45, a text selection module 46 and a text store 47.

The normal font store 44 stores font data defining a conventional typeface. In contrast, the blurred font store 45 stores font data for a modified version of the font stored within the normal font store 44. This modified font comprises data representing the same letters and symbols as are stored within the normal font store 44 where each of the symbols has had a blur function applied to it.

Thus for example where the normal font store 44 will store data representing for example the letter A a corresponding entry in the blurred font store 45 will

have a representation of the same letter A but where the letter A appears blurred.

The text store 47 is arranged to store text, which is to be display on the display screen 41. The text selection module 46 is then arranged to receive instructions via the keyboard 42 and mouse 43 to select text stored from within the text store 47 and generate a display to be shown on the display screen 41.

In this embodiment in order to assist with learning to read, the text selection module 46 is arranged to highlight individual words or parts of words appearing on the display screen 41 in response to input instructions via the keyboard 42 or mouse 43 or through pre-programmed instructions. This is achieved by displaying most text utilising the blurred font stored within the blurred font store 45 and displaying text, which is to be highlighted using the normal font stored within the normal font store 44.

Thus for example as shown in Figure 6 the opening words to the Gettysburg address are displayed on the screen 41 with the word "ago" being highlighted by

being represented in the font corresponding to the normal font 44 whereas the rest of the text on the display screen 41 appears as a blurred font.

By having the text selection module 46 select text to be displayed on the screen 41 and then varying which words appearing on the screen are displayed in either the normal typeface stored within the normal font store 44 or the blurred font stored within the blurred font store 45, the computer 40 is able to direct a user's attention to that successive words in the text appearing on the screen 41.

It is believed that certain reading disabilities such as dyslexia arise due to an inability to separate an individual word or parts of words from the rest of text appearing on a page. The present embodiment would be particularly applicable for assisting dyslexics to read as the blurring of extraneous information reduces the cognitive load on the reader and hence should reduce the amount of confusion.

FURTHER MODIFICATIONS AND AMENDMENTS

It will be appreciated that as the present invention provides an alternative means for highlighting

information in a screen display, the present invention could be used in combination with other methods to enable a variety of different selections of image data, alpha numeric or text data to be simultaneously highlighted.

Thus for example some data might be highlighted by being displayed in a certain colour whilst data selected by different criteria were highlighted using the above described selective blurring technique. In this way, the intersection between to sets of data could be easily identified.

It will also be appreciated that although the drawings accompanying the description are black and white drawings, the present invention is equally applicable to colour displays. An advantage of the present invention when used with colour images would be that the selective blurring of an image would enable information to be highlighted without any loss of colour information or degradation of colour contrast.

In such embodiments, instead of processing a single image, colour data for each of the red, green and blue channels of an original image could be processed to

generated selectively blurred red, green and blue images and then recombined in a conventional way to generate a selectively blurred colour image.

In the first embodiment, the generation of a single blurred image is described. It will be appreciated that in generating a selectively blurred images, different portions of an image could be blurred to a lesser or greater extent. Where more than one level of blurring occurred, a means for identifying a priority for considering areas of an image is provided as ordinarily, a viewer's attention will progressively move from the sharpest to the least sharp areas of an image.

It will also be appreciated that although blurring of images using a Gaussian blur is described, in other embodiments any suitable technique for generating a blurred image could be utilised. Thus for example in the case of a two-tone image, dithering could be utilised. Alternatively, images could be blurred by utilising stored ramping or feathering algorithms to make areas of an image less distinct.

Further, although in the above embodiments the

generation of blurred images is described where the images are generated through image processing, it will be appreciated that instead of generating blurred image data, adaptive optical systems could be provided which caused areas of a display to appear blurred to a viewer.

Although in the fourth embodiment, the pre-storing of blurred and sharp font data is described, it will be appreciated that more generally blurred and sharp image data could be pre-stored for generating any type of image display. Thus, for example, blurred and sharp icon data could be pre-stored so as to facilitate the generation of selectively blurred images including representations of icons.

Although four embodiments of the present invention have been described in detail, it will be appreciated that the present invention will have many other applications. In general, the present invention is applicable in any complex decision making environment where it is desirable to draw a user's attention to specific portions or areas of a display.

Thus for example, in addition to the examples of

cockpits and in-car navigation systems described in the first three embodiments, the present invention could also be applied to control rooms and simulation displays for safety critical systems such as for example air traffic control systems, integrated operations control systems for rail or public transport or safety control systems for power plants and factories etc. Equally, the present invention could be used to highlight information on trading screens in a financial trading system where it was desirable to direct a user's attention to certain information.

Further, in other embodiments, the present invention could be applied to highlight areas of security camera images, which are determined to be of interest and hence could be utilised to assist in the tracking of suspect individuals in CCT images.

Although the embodiments of the invention described with reference to the drawings comprise computer apparatus and processes performed in computer apparatus, the invention also extends to computer programs, particularly computer programs on or in a carrier, adapted for putting the invention into

practice. The program may be in the form of source or object code or in any other form suitable for use in the implementation of the processes according to the invention. The carrier may be any entity or device capable of carrying the program.

For example, the carrier may comprise a storage medium, such as a ROM, for example a CD ROM or a semiconductor ROM, or a magnetic recording medium, for example a floppy disc or hard disk. Further, the carrier may be a transmissible carrier such as an electrical or optical signal, which may be conveyed via electrical or optical cable or by radio or other means.

When a program is embodied in a signal, which may be conveyed, directly by a cable or other device or means, the carrier may be constituted by such cable or other device or means.

Alternatively, the carrier may be an integrated circuit in which the program is embedded, the integrated circuit being adapted for performing, or for use in the performance of, the relevant processes.

CLAIMS

1. An image generation apparatus, comprising:

a receiver operable to receive image data;

a selector operable to select one or more portions in an image as portions of an image which are to be emphasised; and

an image processing unit operable to process image data received by said receiver to generate a composite image in which the portions of said composite image corresponding to said portions to be emphasised selected by said selector correspond to said portions of the image defined by data received by said receiver and in which other portions of said composite image correspond to the other portions of the image defined by said data received by said receiver to which a blurring function has been applied.

2. An image generation apparatus in accordance with claim 1 wherein said image processing unit comprises:

a blurring engine operable to generate a blurred image corresponding to an image received by said receiver; and

a composite image generator operable to generate composite images comprising portions of images

selected from images defined by image data received by said receiver and portions of images generated by said blurring engine on the basis of selections of portions of an image to be emphasised made by said selector.

3. An image generation apparatus in accordance with claim 2 wherein said blurring engine is operable to generate blurred images corresponding to images received by said receiver by deriving pixel values for pixels in a blurred image corresponding to pixels in said image defined by received image data by calculating a weighted average of received image data weighted by a function dependent upon the distance between a pixel in an image for which pixel data is being generated and a corresponding pixel in said image being utilised to calculate said weighted average.

4. An image generation apparatus in accordance with claim 3 wherein said function dependent upon distance comprises a Gaussian function.

5. An image generation apparatus in accordance with claim 1, wherein said image processing unit is operable to generate a composite image by determining

pixel data for areas of an image selected by selector as portions of an image to be emphasised by copying image data for said pixels from image data received by said receiver and to determine pixel data for the remaining portions of a composite image by calculating for pixels in said remaining portions of a composite image a weighted average of received image data weighted by a function dependent upon the distance between a pixel in an image for which pixel data is being generated and a corresponding pixel in said image being utilised to calculate said weighted average.

6. An image generation apparatus in accordance with claim 5 wherein said function dependent upon distance comprises a Gaussian function.

7. An image generation apparatus in accordance with claim 5 or 6 wherein said image processing unit comprises:

a data store storing function data defining a plurality of functions operable to derive composite image data from image data received by said receiver in which some portions of a composite image correspond to said portions of the image defined by data received

by said receiver and in which other portions of said composite image correspond to the other portions of the image defined by said data received by said receiver to which a blurring function has been applied;

a selection unit operable to select function data defining a function from said data store on the basis of the one or more areas selected as portions of an image to be emphasised by said selector; and

a processing unit operable to generate a composite image utilising image data received by said receiver and function data selected by said selection unit.

8. An image generation apparatus in accordance with any preceding claim, further comprising:

one or more detectors operable to obtain readings of external conditions; and

a status determination unit operable to determine a current status on the basis of readings received from said detectors, wherein said selector is operable to receive status data and select areas to be emphasised based on received status data.

9. An image generation apparatus in accordance with

claim 8 wherein said selector is responsive to receipt of status data identifying a default status to cause said selector to identify the entirety of an image as being the portion of an image to be emphasised.

10. An image generation apparatus in accordance with claim 8 or 9 further comprising:

a display generation unit operable to generate image data defining an image identifying at least one reading obtained by said one or more detectors and to pass generated images to said receiver.

11. An image generation apparatus in accordance with any preceding claim wherein said image processing unit is operable to process image data received by said receiver to generate a composite image in which portions of the image defined by data received by said receiver which do not correspond to portions to be emphasised selected by said selector correspond to said portions of the image defined by said data received by said receiver to which a number of different blurring functions have been applied.

12. An image generation apparatus in accordance with claim 11 wherein said selector is operable to

associate portions of said image with data indicative of a level of importance wherein said image processing unit is operable to generate a composite image in which portions of a composite image associated with decreasing levels of importance appear to be increasingly blurred.

13. A navigation system comprising:

a route determination unit operable to calculate a route from a present location to a desired location;

a map generation module operable to generate image data defining a map; and

image generation apparatus in accordance with any of claims 1-9, wherein said receiver is operable to receive image data defining a map generated by said map generation module, and said selector is operable to select as portions of an image to be selected portions of a generated map corresponding to one or more parts of a route determined by said route determination module.

14. An image generation apparatus for generating a selectively blurred image including representations of text comprising:

a first font store storing data defining a first

font;

a second font store storing data defining a second font corresponding to said first font to which a blurring function has been applied;

a display definition module operable to identify text data to be displayed;

a selection unit operable to select one or more items of text data to be displayed as text data to be emphasised; and

an image generation module operable to generate image data representing text data identified by said display definition module, wherein text data selected to be emphasised by said selection unit is displayed as text data appearing in the font defined by said first font stored by said first font store and the remaining text data is displayed as text data in the font defined by said second font stored by said second font store.

15. An image generation method, comprising:

receiving image data;

receiving selection data identifying one or more portions in an image as portions of an image which are to be emphasised; and

processing received image data to generate a

composite image in which the portions of said composite image corresponding to said portions to be emphasised identified by received selection data correspond to said portions of the image defined by received image data and in which other portions of said composite image correspond to the other portions of the image defined by said received image data to which a blurring function has been applied.

16. A method in accordance with claim 15 wherein said processing received image data comprises:

generating a blurred image by processing said received image data; and

generating composite image comprising portions defined by said received image data and portions of said generated blurred image.

17. A method in accordance with claim 16 wherein generating a blurred image comprises deriving pixel values for pixels in a blurred image corresponding to pixels in said defined by received image data by calculating a weighted average of received image data weighted by a function dependent upon the distance between a pixel in an image for which pixel data is being generated and a corresponding pixel in said

image being utilised to calculate said weighted average.

18. A method in accordance with claim 17 wherein said function dependent upon distance comprises a Gaussian function.

19. A method in accordance with claim 15, wherein processing received image data to generate a composite image comprises:

determining pixel data for areas of an image identified by selection data as portions of an image to be emphasised by copying image data for said pixels from received image data; and

determining pixel data for the remaining portions of a composite image by calculating for pixels in said remaining portions of a composite image a weighted average of received image data weighted by a function dependent upon the distance between a pixel in an image for which pixel data is being generated and a corresponding pixel in said image being utilised to calculate said weighted average.

20. A method in accordance with claim 19 wherein said function dependent upon distance comprises a Gaussian

function.

21. A method in accordance with claim 19 or 20 further comprising:

storing function data defining a plurality of functions operable to derive composite image data from received image data in which some portions of a composite image correspond to said portions of the image defined by received image data and in which other portions of said composite image correspond to the other portions of the image defined by said data received by said receiver to which a blurring function has been applied;

selecting stored function data defining a function on the basis of received selection data; and

generating a composite image utilising received image data and said selected function data.

22. A method in accordance with any of claims 15- 21, further comprising:

obtaining one or more readings of external conditions; and

determining a current status on the basis of received readings; and

generating selection data on the basis of

received status data.

23. A method in accordance with claim 22 comprising: generating selection data in response to receipt of status data identifying a default status identifying the entirety of an image as being the portion of an image to be emphasised.

24. A method in accordance with claim 22 or 23 further comprising:

generating image data defining an image identifying at least one obtained reading.

25. A method in accordance with any of claims 15-24 wherein processing image data to generate a composite image comprises:

generating a composite image in which portions of an image defined by received image data which do not correspond to portions to be emphasised identified by received selection data correspond to portions of the image defined by said received image data to which a number of different blurring functions have been applied.

26. A method in accordance with claim 25 wherein said

selection data associates portions of an image with data indicative of a level of importance wherein said processing of image data comprises generating a composite image in which portions of a composite image associated with decreasing levels of importance appear to be increasingly blurred.

27. An image generation method for generating a selectively blurred image including representations of text comprising:

storing data defining a first font;

storing data defining a second font corresponding to said first font to which a blurring function has been applied;

identifying text data to be displayed;

selecting one or more items of text data to be displayed as text data to be emphasised; and

generating image data representing said identified text wherein text data selected to be emphasised is displayed as text data appearing in the font defined by said first font and the remaining text data is displayed as text data in the font defined by said second font.

28. A computer readable medium storing computer

implementable instructions for causing a programmable computer to perform a method in accordance with any of claims 15-27.

29. A computer readable medium in accordance with claim 28 comprising a disk.

30. A disk in accordance with claim 29 comprising a magnetic, magneto-optic or optical disk.

31. A computer readable medium in accordance with claim 28 comprising an electrical signal within a computer network.

32. An apparatus for generating selectively blurred images substantially as described herein with reference to the accompanying drawings.

33. A method of generating selectively blurred images substantially as described herein with reference to the accompanying drawings.

ABSTRACT

IMAGE PROCESSING SYSTEM

An image processing system is described which is arranged to highlight information in image displays by selectively blurring less important areas of an image. By generating such displays comprising areas which are in focus and areas which are out of focus, a viewer's attention is preferentially drawn towards those areas of an image which appear sharp. By having a display system which is arranged to generate such images a means is provided to direct a viewer's attention towards considering the sharp areas of the image display first. Further the selective blurring portions of an image reduces rather than increases the amount of information presented to a viewer and hence reduces the likelihood that a viewer will become overloaded with information. Display systems of this type are therefore especially applicable to complex control environments as means of directing viewer's attention.

Fig. 2C

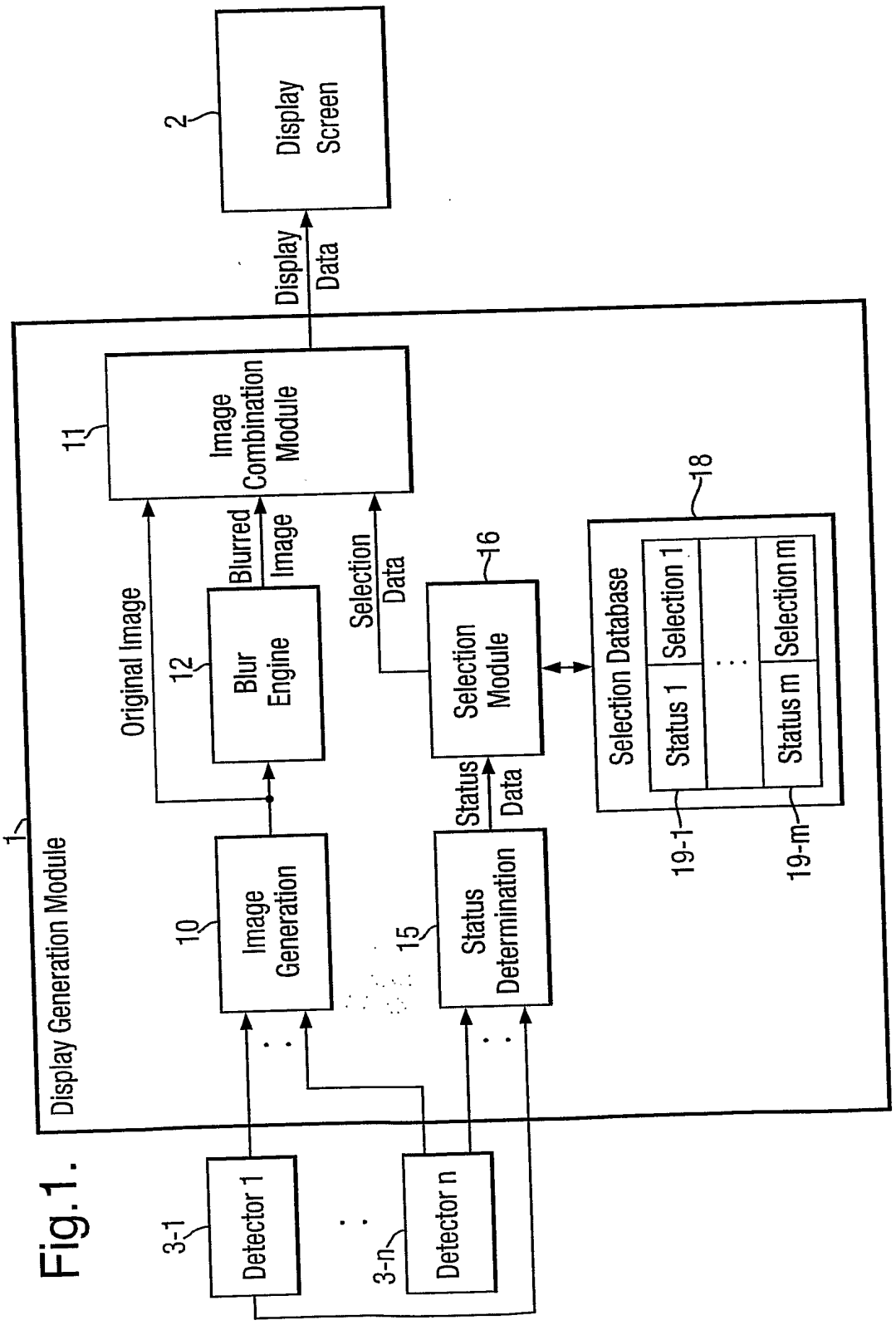

2
Display Screen
Display Data
1
Display Generation Module
11
Image Combination Module
Blurred Image
Original Image
12
Blur Engine
Selection Data
16
Selection Module
18
Selection Database
Selection 1
Status 1
Selection m
Status m
19-1
19-m
Status Data
10
Image Generation
15
Status Determination
3-1
Detector 1
3-n
Detector n

Fig.1.

Fig.2A.

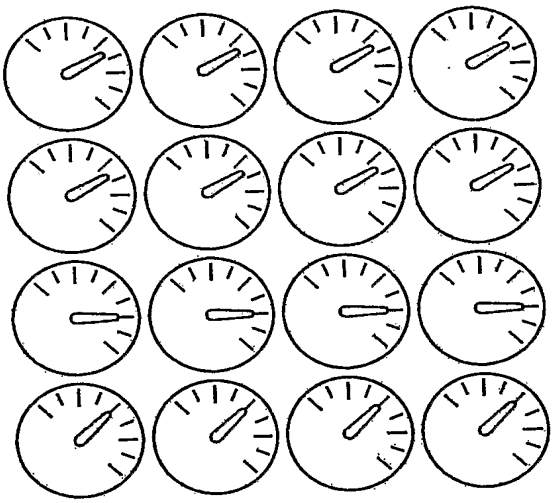


Fig.2B.

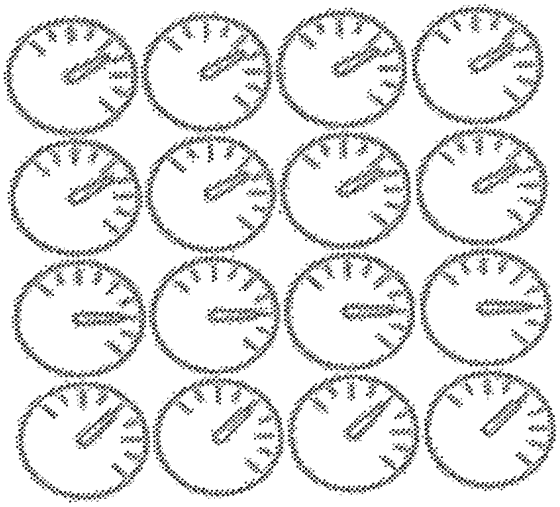


Fig.2C.

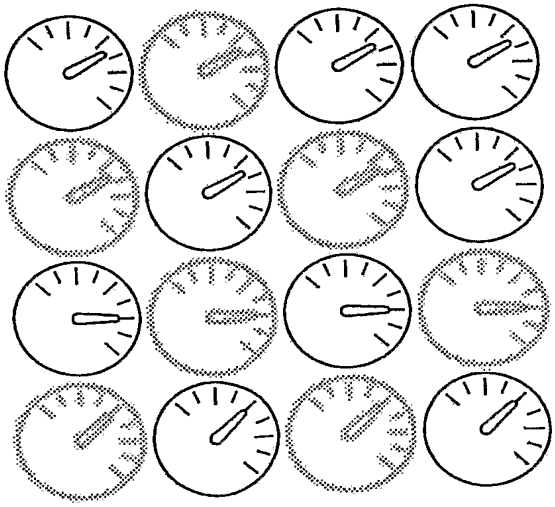
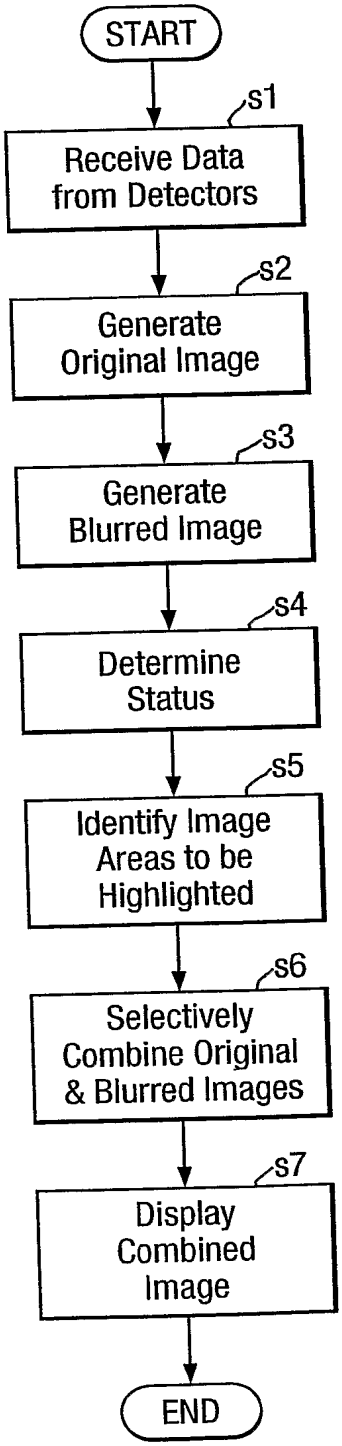


Fig.3.


START
s1
Receive Data from Detectors
s2
Generate Original Image
s3
Generate Blurred Image
s4
Determine Status
s5
Identify Image Areas to be Highlighted
s6
Selectively Combine Original & Blurred Images
s7
Display Combined Image
END

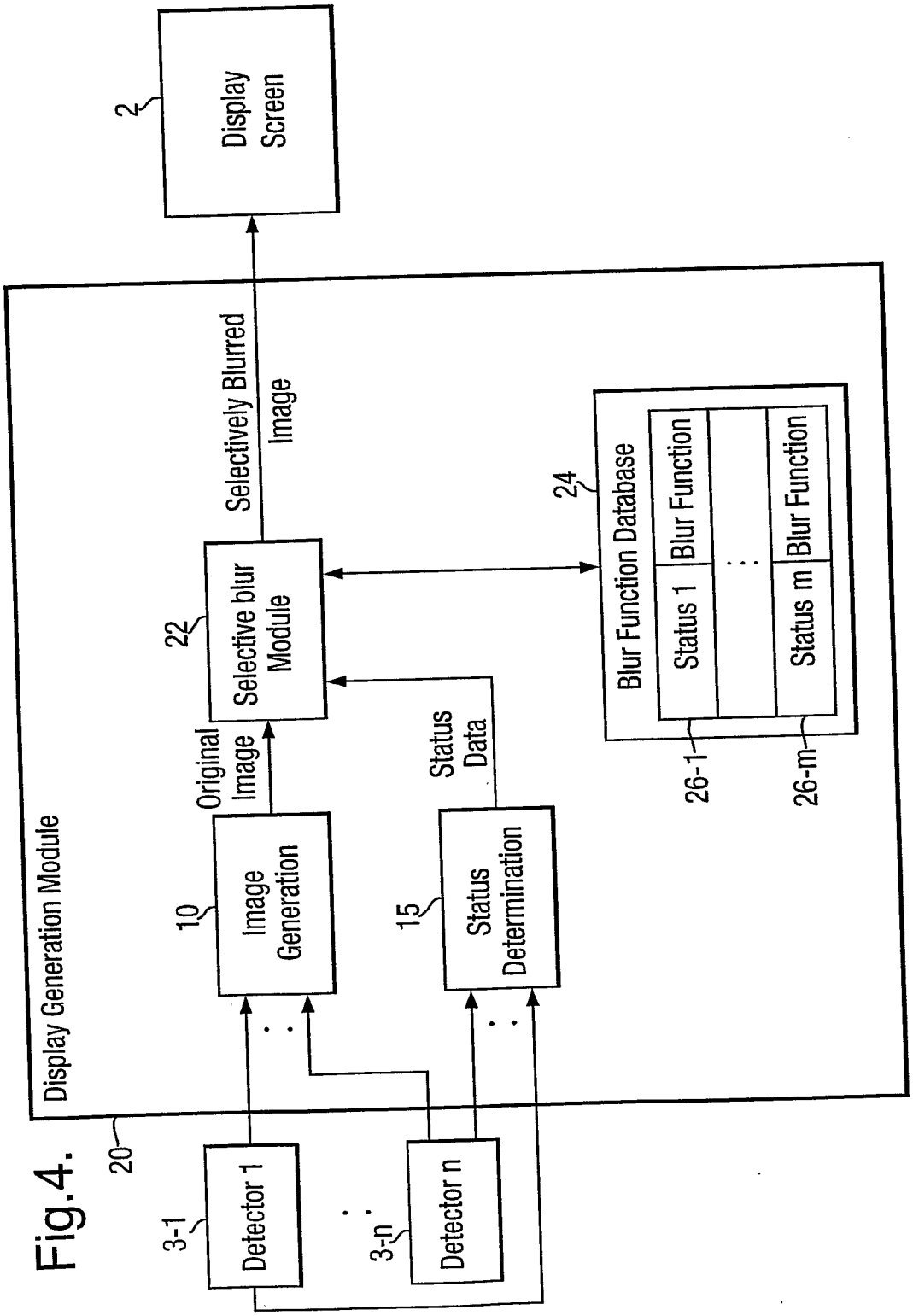

Display Generation Module
20
Detector 1
3-1
Detector n
3-n
Image Generation
10
Original Image
Status Determination
15
Status Data
Selective blur Module
22
Selectively Blurred Image
Display Screen
2
Blur Function Database
24
Status 1
Blur Function
Status m
Blur Function
26-1
26-m

Fig.4.

Fig.5.

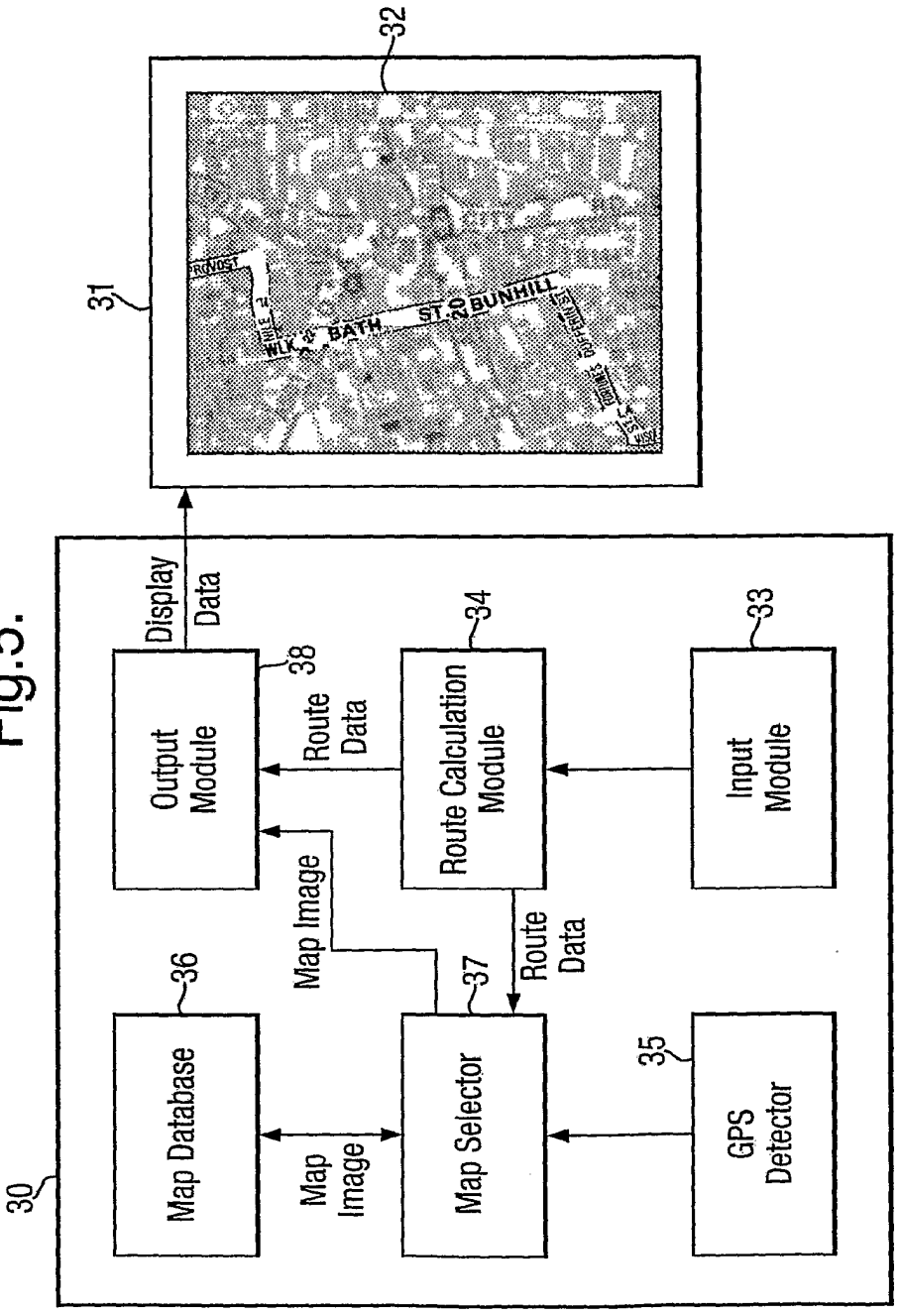
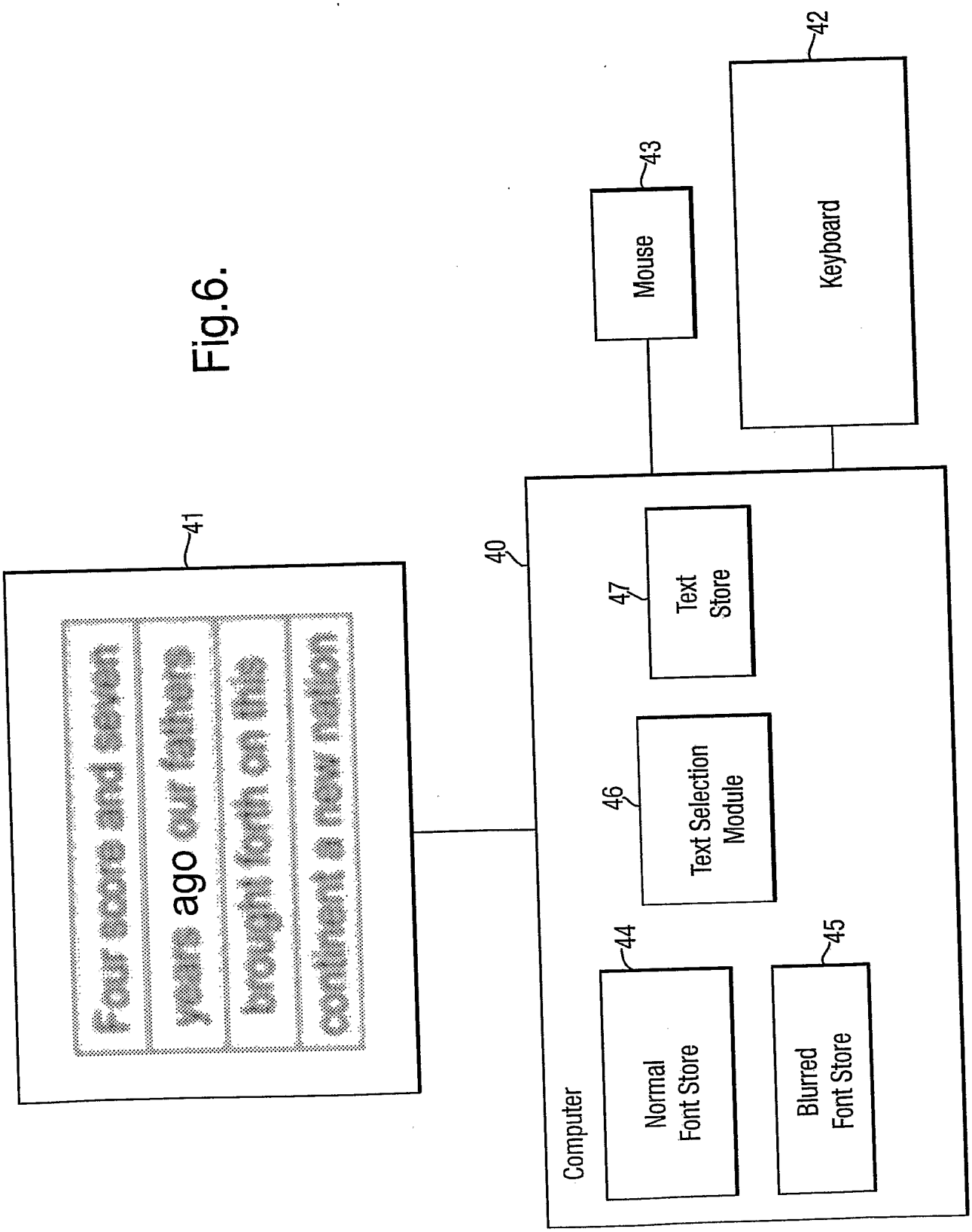

32
31
30
Display Data
Output Module
38
Route Data
Route Calculation Module
34
Input Module
33
Map Image
Route Data
36
37
35
Map Database
Map Image
Map Selector
GPS Detector

Fig.6.


41
Four score and seven
years ago our fathers
brought forth on this
continent a new nation
40
Computer
47
Text
Store
46
Text Selection
Module
44
Normal
Font Store
45
Blurred
Font Store
43
Mouse
42
Keyboard